

## **An Evaluation of the Small-scale Sawmilling and Timber Processing Industry in Northern Vietnam and the Need for Planting Particular Indigenous Species**

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This paper reports findings of surveys into small-scale sawmilling and timber processing in Phu Tho Province and the Tam Dao National Park buffer zone in northern Vietnam. The objective of these surveys was to examine the extent to which small sawmills and timber processors utilise farm-grown timber, so as to explore the prospects for expansion of farm-grown timber markets. The operational scope, supply chain and value chain of the industry are reported. Resource availability and current and future perspectives are discussed. Timber prices were found to vary greatly between species and study areas. Species most in demand by enterprises are *Artocarpus heterophyllus*, *Melia azedarach*, *Manglietia conifera*, *Acacia spp.*, *Chukrasia tabularis* and *Erythrophloeum fordii*. Small-scale sawmilling and timber processing activities fit well with rural communities in Vietnam and have potential for further development if current constraints can be overcome. Further tree planting is needed to meet the presently unsatisfied timber demand and to create income and employment. Information from sawmillers and timber processors suggests the types of species that farmers should be considering for their plantings.

**Keywords:** sawmill, timber processor, buffer zone, Five Million Hectare project, timber supply chain

## INTRODUCTION

Forest cover in Vietnam has declined sharply, from 14 M ha in 1943 to 9.3 M ha in 1995 (Nguyen 1996, 2001). Deforestation has taken place due to war, shifting cultivation, land clearing for agriculture, state logging and illegal logging, infrastructure construction including dams and high voltage power lines, inconsistent land tenure, wildfire and lack of education and environmental awareness (FAO 1997, De Konnick 1999, Nguyen and Gilmour 1999, Lang 2001). Deforestation has resulted in environmental degradation including forest fragmentation, biodiversity reduction and increased incidence of natural disasters, as well as seriously affecting living conditions and incomes of rural people, particularly those depending mostly on forests for subsistence.

Logging bans were promulgated in the early 1990s when the negative impacts of deforestation were recognised. Reforestation activities have been widely promoted to rehabilitate deforested areas, as well as to meet timber and non-timber forest product needs. Two notable reforestation programs are *Program 327* and the *Five Million Hectare Reforestation Program*. Most early reforestation was carried out using exotic tree species, particularly eucalypts and acacias (Nguyen and Gilmour 1999). This is despite indigenous tree species providing a wide range of social and cultural benefits including preserving traditional foods and medicines and having aesthetic value (Keenan *et al.* 1999). In addition, some tree species indigenous to northern Vietnam have excellent timber quality and attract high market prices.

Expansion of small-scale forestry is a potential strategy to achieve reforestation objectives. Critical to the attractiveness of smallholder forestry is the availability of markets and adequate log prices. The opportunity to market logs depends on the timber demand across the various tree species, and the availability of sawmilling and further timber processing facilities. While portable sawmilling is used extensively for milling farm-grown timber in a number of developing countries (see for example Smorfitt *et al.* 2001), fixed-site small-scale timber enterprises are likely to be the main users of the timber arising from smallholder forestry in northern Vietnam.

Surveys were conducted to obtain information about small-scale sawmilling and timber processing<sup>1</sup> and the extent to which small timber enterprises utilise farm-grown timber. The intent of these surveys was to explore the potential for the expansion of farm-grown timber plantations to supply these markets. The study reported here is confined to operational types and facilities, timber sources, acquisition prices, timber product types and prices, customer types, most preferred tree species and their availability, and future prospects as perceived by the operators of small timber processing enterprises.

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<sup>1</sup> The term 'sawmill' is used to refer to facilities where timber is sawn into planks, and 'timber processor' is taken to mean facilities where sawn timber is used to make furniture and other timber products. The two types of enterprises (which are sometimes integrated) are referred to collectively as 'timber enterprises'.

TDMP).<sup>2</sup> Results of this research form part of overall results of the ACIAR Project which will be passed on to the *Five Million Hectare Reforestation Program* secretariat. This study also provides important insights for the newly-initiated *GTZ-TDMP Project* on the operation of timber enterprises and forestry activities in the TDNP buffer zone. The following section outlines the research method employed. Survey findings are then discussed and implications are drawn for the sawmilling and timber processing industry as well as reforestation activities in Vietnam.

## SURVEY DESIGN AND METHOD

The need to examine the supply chain of farm-grown timber was identified during fieldwork in ACIAR Project FST/2000/003 in Phu Tho Province in January 2002. Phu Tho Province was chosen because the ACIAR project involves collaboration between Australian researchers and staff of the Forest Research Centre, which is located in this province. The prevalence of small-scale fixed-site timber mills was observed along major roads in the province.<sup>3</sup> The Tam Dao National Park (TDNP) buffer zone was subsequently added as a survey site because of activities of the ACIAR project being conducted in the park and because it is a target area for the GTZ-TDMP Project. The survey revealed that that little timber milling takes place in TDNP, though there are numerous small-scale furniture makers, most of whom buy-in sawn timber.

The first section of the questionnaire included questions seeking personal information (name, gender, age and address). The next section covered the workforce and activities of timber enterprises. The following three sections were designed to elicit information about the supply chain and value chain of the sawmilling and timber processing industry. Finally, questions were included on the difficulties in timber acquisition and milling or further processing operations encountered by timber enterprises. The questionnaire included closed, short answer, multiple-choice and open-ended questions.

The survey was conducted in two periods, namely December 2003 – January 2004 and August – September 2004. During the first period, timber enterprises were interviewed in Phu Tho Province and in Tam Dao district in the TDNP buffer zone. In the second period, interviews were carried out in Son Duong and Dai Tu districts in the TDNP buffer zone. The target was to conduct 25 interviews in each of Phu Tho Province, Tam Dao district, Son Duong district and Dai Tu district. The intended interviewees were the owners or the managers of the timber enterprises. When the owner or the director was not accessible, his wife was interviewed. A total of 90 interviews was finally conducted, 19 in Tam Dao district, 21 in Son Duong district, 25 in Dai Tu district and 25 in Phu Tho Province. Almost all timber enterprises were included in the TDNP buffer zone, and over half of total number in Phu Tho province. Enterprises visited consisted of small family-run operations, and

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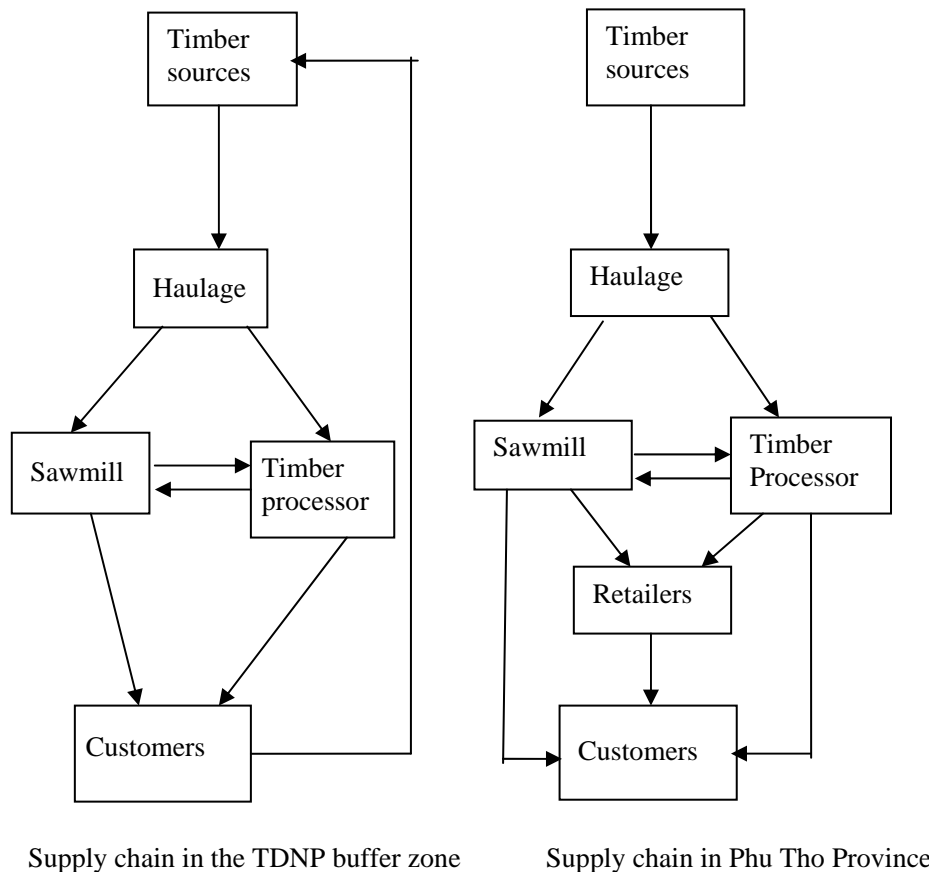
<sup>2</sup> ACIAR is the Australian Centre for International Agricultural Research, and GTZ is the Deutsche Gesellschaft für technische Zusammenarbeit (GTZ) GmbH.

<sup>3</sup> A questionnaire for a survey of small-scale timber mills was drafted by Drs Harrison and Lamb. The survey, data analysis and interpretation were then conducted by Ms Bui as part of the requirement for B.Env.Sc. honours at The University of Queensland, Australia.

private and state companies. No contact was made in advance of the visit and no money was given to the interviewees. The response rate to the survey was 100%.

### THE SUPPLY CHAIN

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturers and suppliers, but also transporters, warehouses, retailers and customers (Monczka *et al.* 2002, Chopra and Meindl 2004). In Phu Tho Province, timber enterprises buy timber from various sources then sell products to both customers and retailers. In the TDNP buffer zone, timber enterprises sell directly to customers, thus bypassing the retailers. The two types of supply chain are depicted in Figure 1.



**Figure 1.** Supply chain of the small-scale sawmilling and timber processing industry in study areas in northern Vietnam

## CHARACTERISTICS OF TIMBER ENTERPRISES

### Characteristics of Sawmillers and Timber Processing Operators

Males play a dominant role in sawmilling and timber processing business, being 84% of respondents in Tam Dao district, 100% in Son Duong district, 96% in Dai Tu district and 84% in Phu Tho Province. The age distribution of respondents is indicated in Table 1. Respondents were in general younger in Tam Dao and Dai Tu districts than in Son Duong district and Phu Tho Province. Approximately 84% were aged less than 50 years in Phu Tho Province, 100% in Tam Dao district, 67% in Son Duong district and 96% in Dai Tu district.

**Table 1.** Age distribution of respondents in Phu Tho Province and the Tam Dao National Park buffer zone

| Age (years)  | Phu Tho Province |     | TDNP Buffer Zone |     |                    |     |                 |     |
|--------------|------------------|-----|------------------|-----|--------------------|-----|-----------------|-----|
|              |                  |     | Tam Dao District |     | Son Duong District |     | Dai Tu District |     |
|              | No.              | %   | No.              | %   | No.                | %   | No.             | %   |
| Less than 20 | 0                | 0   | 0                | 0   | 0                  | 0   | 0               | 0   |
| 20-29        | 2                | 8   | 6                | 32  | 1                  | 5   | 4               | 16  |
| 30-39        | 13               | 52  | 6                | 32  | 8                  | 38  | 12              | 48  |
| 40-49        | 6                | 24  | 7                | 37  | 5                  | 24  | 8               | 32  |
| 50-59        | 3                | 12  | 0                | 0   | 6                  | 29  | 1               | 4   |
| 60 or more   | 1                | 4   | 0                | 0   | 1                  | 5   | 0               | 0   |
| Total        | 25               | 100 | 19               | 100 | 21                 | 100 | 25              | 100 |

### Characteristics of the Workforce in Timber Enterprises

Table 2 presents the number of full-time and seasonal workers in the timber enterprises (including the owner or manager). Seasonal workers were employed during peak season, particularly before the Lunar New Year or 'Tet'. Twenty-four of the timber enterprises (96%) in Phu Tho Province employed more than three full-time workers. This contrasts with the TDNP buffer zone where most timber enterprises employed less than two full-time workers including the owner, i.e. 14 (74%) in Tam Dao district, 20 (95%) in Son Duong district and 16 (64%) in Dai Tu district. The median numbers of full-timber workers and seasonal workers were eight and two respectively in Phu Tho Province. The median numbers were two and one in Tam Dao District, one and zero in Son Duong District and two and zero in Dai Tu district. The greater number of employees in enterprises in Phu Tho Province was associated with a larger scale of operation.

### Operational Activities of the Timber Enterprises

A diverse operational scope of the sawmilling and timber processing industry was observed in Phu Tho Province, consisting of state and private enterprises and small sawmills and timber processors. As indicated in Table 3, there was a total of 14 processors, who performed the complete chain of operations including milling,

dressing and making final products. The scale of operation was more limited in the TDNP buffer zone. Sixteen out of 19 enterprises in Tam Dao district and 17 out of 21 in Son Duong district did not mill logs but carried out further timber processing. The low number of sawmills in the buffer zone appears to be associated with the difficulty in obtaining a certificate to purchase a small chainsaw to operate there. It is also less expensive for small timber processors to purchase sawn timber or contract to have timber milled rather than mill it themselves because of the high investment in machines required and the high cost of electricity. Interestingly, more sawmills could be found in Dai Tu district, 11 firms carrying out both milling round logs and processing sawn timber. In fact, within the buffer zone both the sawmilling and timber processing operations are most developed in Dai Tu district.

**Table 2.** Distribution of number of full-time and seasonal workers of timber enterprises in Phu Tho Province and the TDNP buffer zone

| Number of workers        | Phu Tho Province |          | TDNP Buffer Zone |          |                    |          |                 |          |
|--------------------------|------------------|----------|------------------|----------|--------------------|----------|-----------------|----------|
|                          |                  |          | Tam Dao District |          | Son Duong District |          | Dai Tu District |          |
|                          | Full-time        | Seasonal | Full-time        | Seasonal | Full-time          | Seasonal | Full-time       | Seasonal |
| 0                        | 0                | 10       | 0                | 9        | 0                  | 15       | 0               | 13       |
| 1-2                      | 1                | 8        | 14               | 8        | 20                 | 3        | 16              | 8        |
| 3-5                      | 9                | 4        | 4                | 2        | 1                  | 3        | 8               | 4        |
| 6-9                      | 3                | 0        | 1                | 0        | 0                  | 0        | 1               | 0        |
| 10-20                    | 7                | 3        | 0                | 0        | 0                  | 0        | 0               | 0        |
| 21-49                    | 3                | 0        | 0                | 0        | 0                  | 0        | 0               | 0        |
| 50                       | 2                | 0        | 0                | 0        | 0                  | 0        | 0               | 0        |
| Total no. of respondents | 25               | 25       | 19               | 19       | 21                 | 21       | 25              | 25       |

**Table 3.** Categories of timber enterprises in Phu Tho Province and the TDNP buffer zone

| Type of enterprise                         | Phu Tho Province | TDNP Buffer Zone |                    |                 |
|--|------------------|------------------|--------------------|-----------------|
|  |                  | Tam Dao District | Son Duong District | Dai Tu District |
| State enterprises <sup>a</sup>             | 2                | 0                | 0                  | 0               |
| Private companies <sup>a</sup>             | 7                | 0                | 0                  | 0               |
| Small local sawmills                       | 2                | 1                | 1                  | 1               |
| Small local timber processors              | 9                | 16               | 17                 | 11              |
| Small local sawmills and processors        | 4                | 3                | 4                  | 11              |
| Timber production cooperative <sup>a</sup> | 1                | 0                | 0                  | 0               |
| Small lathing mill                         | 0                | 0                | 0                  | 2               |
| Total                                      | 25               | 19               | 21                 | 25              |

<sup>a</sup> State enterprises, private companies and timber production cooperatives carried out both milling round logs and processing sawn timber.

## TIMBER AND TIMBER PRODUCT FINDINGS

### Sources of Timber

Timber sources are summarised in Table 4. In Phu Tho Province, approximate 80% of operations had timber supplied from timber merchants and 68% from home gardens. One enterprise imported timber from Laos. In contrast, in Tam Dao district, 95% of timber enterprises purchased timber from home gardens. Home gardens were also major sources of timber in Son Duong and Dai Tu districts. Another major source of timber in these two districts was customers who supplied the timber and paid the timber processors on a contract basis for milling. Some operators utilise logs from their own forested land and from liquidated stock (timber confiscated by forest rangers from illegal loggers but then sold legally). In other words, timber enterprises in the TDNP buffer zone and some in Phu Tho Province rely mainly on farm-grown timber. The role of timber merchants is clearer in Phu Tho Province where the demand for timber and the range of tree species milled is highest.

**Table 4.** Timber sources for enterprises in Phu Tho Province and the TDNP buffer zone

| Timber source    | Phu Tho Province |     | TDNP Buffer Zone |     |                    |     |                 |     |
|------------------|------------------|-----|------------------|-----|--------------------|-----|-----------------|-----|
|                  |                  |     | Tam Dao District |     | Son Duong District |     | Dai Tu District |     |
|                  | No.              | %   | No.              | %   | No.                | %   | No.             | %   |
| Timber merchant  | 20               | 80  | 2                | 11  | 3                  | 14  | 6               | 24  |
| Home garden      | 17               | 68  | 18               | 95  | 15                 | 71  | 22              | 88  |
| Liquidated stock | 6                | 24  | 0                | 0   | 0                  | 0   | 0               | 0   |
| Plantations      | 4                | 16  | 0                | 0   | 0                  | 0   | 0               | 0   |
| Import           | 1                | 4   | 0                | 0   | 0                  | 0   | 0               | 0   |
| Customer         | 0                | 0   | 0                | 0   | 10                 | 48  | 16              | 64  |
| Self-supplied    | 0                | 0   | 0                | 0   | 3                  | 14  | 1               | 4   |
| Totals           | 25               | 100 | 19               | 100 | 21                 | 100 | 25              | 100 |

Note: Enterprises may acquire timber from several sources.

### Species Used by Timber Enterprises

Information was obtained about tree species acquisition for the years 2000 and 2003. A wide variety of tree species, both exotic and native, is purchased and processed by timber enterprises. As indicated in Table 5 and Table 6, there has been a decline in use of native high-value species including *Chukrasia tabularis* (lat hoa), *Erythrophloeum fordii* (lim xanh), *Fokienia hodginsii* (po mu) and *Madhuca pasquieri* (sen), and an increase in use of fast-growing, farm-grown tree species including acacias, eucalypts, *Melia azedarach* (xoan), *Manglietia conifera* (mo) and *Artocarpus heterophyllus* (mit). A shortage has occurred in indigenous high-value tree species because of government forest protection policies, timber exploitation bans and lack of native tree plantations. Most current plantings are of fast-growing species. Those most in demand and most used is *Artocarpus heterophyllus*, a medium-rotation, medium-quality and mid-range value timber. This species has

been planted for many years in home gardens in rural areas for fruit production, and has become an alternative timber source as the supply of timber from native forests have dwindled.

**Table 5.** Number of timber enterprises obtaining particular tree species in Phu Tho Province years 2000 and 2003 (total number of timber enterprises is 25)

| Scientific name                   | Vietnamese name | Phu Tho Province |           |
|-----------------------------------|-----------------|------------------|-----------|
|                                   |                 | Year 2000        | Year 2003 |
| <i>Acacia spp.</i>                | Keo             | 9                | 13        |
| <i>Artocarpus heterophyllus</i>   | Mit             | 16               | 21        |
| <i>Canarium spp.</i>              | Tram            | 7                | 7         |
| <i>Chukrasia tabularis</i>        | Lat hoa         | 1                | 0         |
| <i>Cinnamomum parthenoxylum</i>   | Re huong        | 2                | 2         |
| <i>Dimocarpus logan</i>           | Nhan            | 5                | 8         |
| <i>Dracontomelon duperreanum</i>  | Sau             | 5                | 5         |
| <i>Erythrophloeum fordii</i>      | Lim xanh        | 3                | 3         |
| <i>Eucalyptus spp.</i>            | Bach dan        | 7                | 9         |
| <i>Excentrodendron tonkinense</i> | Nghien          | 3                | 3         |
| <i>Fokienia hodginsii</i>         | Po mu           | 5                | 5         |
| <i>Khaya senegalensis</i>         | Xa cu           | 6                | 6         |
| <i>Litchi chinensis</i>           | Vai             | 2                | 3         |
| <i>Lithocarpus spp.</i>           | Soi             | 5                | 5         |
| <i>Machilus spp.</i>              | Khao            | 1                | 1         |
| <i>Madhuca pasquieri</i>          | Sen             | 8                | 8         |
| <i>Manglietia conifera</i>        | Mo              | 11               | 15        |
| <i>Markhamia stipulate</i>        | Dinh            | 2                | 1         |
| <i>Melia azedarach</i>            | Xoan            | 14               | 19        |
| <i>Michelia mediocris</i>         | Gioi            | 7                | 8         |
| <i>Ormosia spp.</i>               | Rang rang       | 1                | 1         |
| <i>Pinus spp.</i>                 | Thong           | 3                | 3         |
| <i>Senna siamea</i>               | Muong           | 1                | 1         |
| <i>Styrax tonkinensis</i>         | Bo de           | 8                | 11        |
| <i>Tectona grandis</i>            | Tech            | 0                | 0         |
| <i>Vatica spp.</i>                | Tau             | 2                | 1         |
| <i>Pelthophorum tonkinensis</i>   | Lim xet         | 0                | 0         |
| <i>Chisocheton paniculatus</i>    | Quech           | 0                | 0         |
| <i>Vernicia montana</i>           | Trau            | 0                | 0         |



**Table 6.** Number of timber enterprises obtaining particular tree species in the TDNP buffer zone, years 2000 and 2003 (total number of timber enterprises is 19 in Tam Dao, 21 in Son Duong and 25 in Dai Tu)

| Scientific name                   | Vietnamese name | TDNP Buffer Zone District |      |           |      |        |      |
|-----------------------------------|-----------------|---------------------------|------|-----------|------|--------|------|
|                                   |                 | Tam Dao                   |      | Son Duong |      | Dai Tu |      |
|                                   |                 | 2000                      | 2003 | 2000      | 2003 | 2000   | 2003 |
| <i>Acacia spp.</i>                | Keo             | 8                         | 11   | 3         | 18   | 2      | 23   |
| <i>Artocarpus heterophyllus</i>   | Mit             | 13                        | 17   | 4         | 16   | 2      | 11   |
| <i>Canarium spp.</i>              | Tram            | 0                         | 1    | 2         | 1    | 1      | 5    |
| <i>Chukrasia tabularis</i>        | Lat hoa         | 2                         | 1    | 2         | 2    | 3      | 6    |
| <i>Cinnamomum parthenoxylum</i>   | Re huong        | 1                         | 0    | 5         | 2    | 0      | 0    |
| <i>Dimocarpus logan</i>           | Nhan            | 4                         | 5    | 0         | 1    | 1      | 14   |
| <i>Dracontomelon duperreanum</i>  | Sau             | 3                         | 3    | 0         | 0    | 1      | 2    |
| <i>Erythrophloeum fordii</i>      | Lim xanh        | 1                         | 0    | 0         | 1    | 2      | 0    |
| <i>Eucalyptus spp.</i>            | Bach dan        | 12                        | 17   | 3         | 16   | 0      | 16   |
| <i>Excentrodendron tonkinense</i> | Nghien          | 0                         | 0    | 0         | 0    | 0      | 0    |
| <i>Fokienia hodginsii</i>         | Po mu           | 0                         | 0    | 0         | 0    | 0      | 0    |
| <i>Khaya senegalensis</i>         | Xa cu           | 4                         | 4    | 0         | 2    | 1      | 1    |
| <i>Litchi chinensis</i>           | Vai             | 2                         | 3    | 0         | 0    | 1      | 12   |
| <i>Lithocarpus spp.</i>           | Soi             | 5                         | 4    | 1         | 0    | 2      | 5    |
| <i>Machilus spp.</i>              | Khao            | 2                         | 1    | 7         | 5    | 5      | 7    |
| <i>Madhuca pasquieri</i>          | Sen             | 4                         | 0    | 2         | 1    | 1      | 0    |
| <i>Manglietia conifera</i>        | Mo              | 4                         | 6    | 1         | 6    | 4      | 15   |
| <i>Markhamia stipulate</i>        | Dinh            | 0                         | 0    | 0         | 0    | 1      | 0    |
| <i>Melia azedarach</i>            | Xoan            | 14                        | 19   | 4         | 21   | 4      | 21   |
| <i>Michelia mediocris</i>         | Gioi            | 2                         | 0    | 6         | 5    | 5      | 5    |
| <i>Ormosia spp.</i>               | Rang rang       | 0                         | 0    | 0         | 0    | 0      | 0    |
| <i>Pinus spp.</i>                 | Thong           | 0                         | 1    | 2         | 1    | 2      | 0    |
| <i>Senna siamea</i>               | Muong           | 1                         | 1    | 0         | 0    | 0      | 0    |
| <i>Styrax tonkinensis</i>         | Bo de           | 0                         | 0    | 0         | 1    | 1      | 2    |
| <i>Tectona grandis</i>            | Tech            | 0                         | 0    | 0         | 0    | 0      | 0    |
| <i>Vatica spp.</i>                | Tau             | 0                         | 0    | 0         | 0    | 0      | 0    |
| <i>Pelthophorum tonkinensis</i>   | Lim xet         | 3                         | 1    | 0         | 0    | 0      | 0    |
| <i>Chisocheton paniculatus</i>    | Quech           | 0                         | 0    | 0         | 0    | 1      | 0    |
| <i>Vernicia montana</i>           | Trau            | 0                         | 0    | 0         | 0    | 1      | 4    |

The tree species acquisition patterns in Tam Dao district and Phu Tho Province were relatively stable during the period from 2000 to 2003. In contrast, the pattern changed greatly in Son Duong and Dai Tu districts, where there was a sharp increase in the number of respondents using acacias, eucalypts, *Artocarpus heterophyllus*, *Litchi chinensis* (vai) and *Manglietia conifera*. For example, 15 further timber enterprises acquired acacias in Son Duong district and 21 in Dai Tu district in 2003 relative to 2000. The total number of timber species used was found to be 26 in Phu Tho Province, 20 in Tam Dao district, 17 in Son Duong district and 21 in Dai Tu district.

### Minimum Diameters of Logs Acquired

Some timber processors were able to use logs with small-end diameter under bark (sedub) of as little as 5 cm, to make chopsticks or bed and chair legs. In contrast, the timber processors in Tam Dao district which processed mainly *Chukrasia tabularis* required roundlogs of at least 40 cm in diameter and the railway factory making railway sleepers in Phu Tho Province utilised only *Vatica spp.* with sedub of 40 cm or more.

### Timber Prices by Species in the Study Areas

Timber can be bought as standing trees, round logs and sawn timber. Prices varied with tree species, size and shape and with timber quality. Most respondents reported that the timber price had not been set by the timber merchants. Some reported that the price of timber purchased from timber merchants was approximate 10% to 20% higher than that acquired from home gardens.

The mean log prices for various tree species for years 2000 and 2003 are summarised in Table 7. In both study areas, there has been a statistically significant increase in timber prices from year 2000 to year 2003 ( $p < 0.05$ ).<sup>4</sup> In Phu Tho Province, *Fokienia hodginsii* was the highest priced species at approximately 3.6 M VND<sup>5</sup> per cubic metre in 2000 and 5.4 M VND/m<sup>3</sup> in 2003. By comparison, *Styrax tonkinensis* was the lowest priced species at about 0.3 M VND/m<sup>3</sup> in 2000 and 0.45 M VND/m<sup>3</sup> in 2003. Of tree species for which prices were obtained in the TDNP buffer zone, in year 2000 *Machilus spp.* was highest priced in Tam Dao district, *Chukrasia tabularis* in Son Duong district and *Chisocheton paniculatus* in Dai Tu district. In 2003, the highest-priced tree species in the TDNP buffer zone was *Machilus spp.* in Tam Dao district, *Artocarpus heterophyllus* in Son Duong district and *Chukrasia tabularis* in Dai Tu district.

Over the four study areas, timber prices across species increased from by 10% and 550% from 2000 to 2003. The increases were due to timber shortages arising from logging bans and the unavailability of timber from plantations. Timber prices differed not only between species but also between study sites. For instance, the price of *Michelia mediocris* was approximate 4.5 M VND/m<sup>3</sup> in Phu Tho Province, 2 M VND/m<sup>3</sup> in Son Duong district and 1.2 M VND/m<sup>3</sup> in Dai Tu district. Timber demand, customer requests and market performance contribute to the timber price differences among study areas.

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<sup>4</sup> Means of survey variables have been compared across districts and over time using analysis of variance, as reported in Bui (2004). In that the samples form between about 50% and 100% of the populations of timber processors, the inferential statistical analysis is only meaningful if the four study districts are assumed to be representative of other districts in northern Vietnam.

<sup>5</sup> \$US1.00 = VND16,000, approximately.

**Table 7.** Roundlog price by species in Phu Tho Province and the TDNP buffer zone districts, years 2000 and 2003 (VND1000/m<sup>3</sup>)

| Species                          | TDNP Buffer Zone Districts |       |         |       |           |       |        |       |
|----------------------------------|----------------------------|-------|---------|-------|-----------|-------|--------|-------|
|                                  | Phu Tho Province           |       | Tam Dao |       | Son Duong |       | Dai Tu |       |
|                                  | 2000                       | 2003  | 2000    | 2003  | 2000      | 2003  | 2000   | 2003  |
| <i>Acacia spp.</i>               | 440                        | 575   | 520     | 819   | 300       | 933   |        | 513   |
| <i>Artocarpus heterophyllus</i>  | 1,550                      | 1,998 | 891     | 2,321 | 900       | 2,300 |        | 2,000 |
| <i>Canarium spp.</i>             | 650                        | 925   |         |       |           |       |        | 550   |
| <i>Chisocheton paniculatus</i>   |                            |       |         |       |           |       | 800    |       |
| <i>Chukrasia tabularis</i>       |                            |       |         |       | 1,500     |       |        | 2,000 |
| <i>Cinnamomum obtusifolium</i>   |                            |       |         |       | 700       | 1,400 |        |       |
| <i>Dimocarpus logan</i>          | 680                        | 875   | 300     | 1,650 |           |       |        | 600   |
| <i>Dracontomelon duperreanum</i> | 900                        | 1,200 | 1,100   | 1,400 |           |       |        |       |
| <i>Eucalyptus spp.</i>           | 404                        | 560   | 369     | 760   |           |       |        | 437   |
| <i>Fokienia hodginsii</i>        | 3,567                      | 5,333 |         |       |           |       |        |       |
| <i>Khaya senegalensis</i>        | 1,160                      | 2,000 | 967     | 1,825 |           |       |        |       |
| <i>Litchi chinensis</i>          | 550                        | 800   |         |       |           |       |        | 633   |
| <i>Lithocarpus spp.</i>          | 600                        | 900   | 900     | 1,333 | 500       |       | 800    | 900   |
| <i>Machilus spp.</i>             |                            |       | 1,200   | 2,500 | 650       | 1,400 | 500    | 567   |
| <i>Madhuca pasquieri</i>         | 3,000                      | 3,750 |         |       |           |       |        |       |
| <i>Manglietia confiera</i>       | 611                        | 821   | 800     | 1,325 | 700       | 766   | 550    | 820   |
| <i>Melia azedarach</i>           | 582                        | 785   | 707     | 1,100 | 1,000     | 2,000 | 400    | 546   |
| <i>Michelia mediocris</i>        | 3,467                      | 4,500 |         |       |           |       |        | 1150  |
| <i>Pelthophorum tonkinensis</i>  |                            |       | 1,100   | 2,500 |           |       |        |       |
| <i>Pinus spp.</i>                | 800                        | 1,000 |         |       |           |       |        |       |
| <i>Senna siamea</i>              |                            |       | 900     | 1,800 |           |       |        |       |
| <i>Styrax tonkinensis</i>        | 287                        | 451   |         |       |           |       |        | 500   |
| <i>Vatica spp.</i>               |                            | 3,800 |         |       |           |       |        |       |

### Product Types and Prices

A diverse range of timber products was observed. Enterprises in Phu Tho Province produce furniture, formwork, poles and posts, chopsticks, sleepers, artificial board and fuelwood. In contrast, timber enterprises in the TDNP buffer zone produce mainly basic furniture, turned furniture legs, poles and posts, and fuelwood.

Table 8 summarises the median and mean prices of timber products and of the contract work processing timber products in the four study areas. Furniture prices were found to depend on both timber price and product design. For example, a simple bed made by acacia was typically priced between 0.1 M and 0.3 M VND but beds made of acacia by a skilled carpenter with a complicated design sold for up to 1.5 M VND. Furniture made from high-quality native tree species was always high-priced; for instance, a simple-design bed made by *Fokienia hodginsii* was priced at about 2 M VND. Another type of timber product is disposable wooden chopsticks which are made of *Styrax* and are priced at 41.5 VND/pair (20 cm long) and 48

VND/pair (23 cm). The Viet Tri artificial board and timber processing factory sold particle board at 1.8 M VND/m<sup>3</sup> and fibreboard at 3.5 M VND/m<sup>3</sup>.

**Table 8.** Price by timber products in Phu Tho Province and the TDNP buffer zone districts (VND1000)

| Product type                      | Phu Tho Province |        | TDNP Buffer Zone |       |                    |       |                 |       |
|-----------------------------------|------------------|--------|------------------|-------|--------------------|-------|-----------------|-------|
|                                   |                  |        | Tam Dao District |       | Son Duong District |       | Dai Tu District |       |
|                                   | Median           | Mean   | Median           | Mean  | Median             | Mean  | Median          | Mean  |
| Table and chair set               | 1,000            | 1,390  | 900              | 1,041 | 950                | 950   | 900             | 900   |
| Wardrobe                          | 1,200            | 2,016  | 1,000            | 987   | 800                | 1,151 | 1,000           | 1,040 |
| Bed frame                         | 500              | 686    | 300              | 336   | 300                | 298   | 350             | 377   |
| Door (m <sup>2</sup> )            | 300              | 308    | 210              | 240   | 180                | 173   | 200             | 215   |
| Student table and chair           |                  |        | 50               | 60    | 175                | 170   | 130             | 130   |
| Bed frame (service <sup>a</sup> ) |                  |        |                  |       | 100                | 116   | 70              | 86    |
| Door (service)                    |                  |        |                  |       | 70                 | 70    | 60              | 55    |
| Stair leg                         |                  |        |                  |       |                    |       | 25              | 25    |
| Chopstick (pair)                  | 0.0415           | 0.0415 |                  |       |                    |       |                 |       |
| Particle board (m <sup>3</sup> )  | 1,800            | 1,800  |                  |       |                    |       |                 |       |
| Fibreboard (m <sup>3</sup> )      | 3,500            | 3,500  |                  |       |                    |       |                 |       |

<sup>a</sup> Service work is where a customer provides timber and pays for the contract work for the timber processor to make the final timber product.

Prices vary between product types depending on the amount of timber and labour required. Table and chair sets and wardrobes were among the highest priced items. Prices of timber products were observed to be highest in Phu Tho Province, where timber products are mostly made from high-quality and high-price timber and have complicated designs. The median and mean price of a household table and chair set is approximately 1 M VND for four study sites. On average, the service work of a bed frame was priced at 0.07 M VND in Dai Tu district and 0.1 M VND in Son Duong district.

## CUSTOMER TYPES AND OPINIONS OF TIMBER ENTERPRISE OPERATORS

### Characteristics of Customers

The customer distribution of timber enterprises is illustrated in Table 9. In the TDNP buffer zone, timber enterprises operate mainly to meet demands of local households (90% of customers) and to a much lesser extent, local public works. Customers in Phu Tho Province include not only local households but also private and state enterprises buying wood products for domestic uses or for retailing, and builders who require boards, panels and poles for construction purposes. Customer differences arise because timber sawmilling and processing is better developed in Phu Tho Province, where areas surveyed include urban, rural and mountainous areas, cf. only rural and mountainous areas in the TDNP buffer zone.

**Table 9.** Customer types of timber enterprises in Phu Tho Province and the TDNP buffer zone districts

| Customer type                | Phu Tho Province | TDNP Buffer Zone Districts |           |        |
|------------------------------|------------------|----------------------------|-----------|--------|
|                              |                  | Tam Dao                    | Son Duong | Dai Tu |
| Local household              | 22               | 16                         | 20        | 23     |
| Enterprises                  | 15               | 0                          | 1         | 0      |
| Builder                      | 11               | 3                          | 0         | 1      |
| Railway enterprise           | 1                | 0                          | 0         | 0      |
| Furniture manufacturers      | 2                | 1                          | 0         | 0      |
| Community works <sup>a</sup> | 3                | 3                          | 5         | 7      |
| Total number of enterprises  | 25               | 19                         | 21        | 25     |

<sup>a</sup> Community works are those of community service agencies, including Communal People's Committee Offices, police stations, schools and houses of gratitude (built for war invalids and the families of martyrs).

### Species Preferred by the Timber Enterprises

Table 10 lists the tree species most wanted by respondents. Species of preferences are similar across provinces. Most favoured are native high-value species including *Chukrasia tabularis*, *Madhuca pasquieri* and *Erythrophloeum fordii*, indigenous medium-rotation species including *Artocarpus heterophyllus*, and fast-growing *Manglietia conifera*, *Melia azedarach* and *Acacia spp.* The species preferred by timber enterprises depend on their customer range and scale of operation. Most local households in rural areas in the TDNP buffer zone can only afford relatively low-priced timber furniture and products, hence the preference for *Melia azedarach*, *Manglietia conifera* and *Acacia spp.* In contrast, large enterprises in Phu Tho Province require high-value tree species including *Chukrasia tabularis*, *Erythrophloeum fordii* and *Fokienia hodginsii* to meet the demands of their city markets. Species preferences also depends on product types; for example, *Acacia* timber is best for making artificial boards whereas *Styrax* is best for making disposable wooden chopsticks.

**Table 10.** Most preferred tree species by respondents in Phu Tho Province and the TDNP buffer zone districts

| Location                   |           | Most wanted tree species  |
|----------------------------|-----------|---|
| Phu Tho Province           |           | <i>Chukrasia tabularis</i> , <i>Erythrophloeum fordii</i> , <i>Madhuca pasquieri</i> , <i>Artocarpus heterophyllus</i> , <i>Manglietia conifera</i> , <i>Melia azedarach</i> , <i>Acacia spp.</i> |
| TDNP Buffer Zone Districts | Tam Dao   | <i>Artocarpus heterophyllus</i> , <i>Melia azedarach</i> , <i>Chukrasia tabularis</i>   |
|                            | Son Duong | <i>Melia azedarach</i> , <i>Michelia mediocris</i> , <i>Artocarpus heterophyllus</i> , <i>Manglietia conifera</i> , <i>Acacia spp.</i>  |
|                            | Dai Tu    | <i>Manglietia conifera</i> , <i>Acacia spp.</i> , <i>Melia azedarach</i> , <i>Chukrasia tabularis</i> , <i>Erythrophloeum fordii</i>  |

### **Difficulties Experienced by Timber Enterprises**

Shortage of timber was the key difficulty reported by timber enterprises. Of those enterprises operating before year 2000, 65% in Phu Tho Province, 60% in Dai Tu district and 92% in Tam Dao and Son Duong districts reported a reduction in timber availability – ranging between 20% and 90% – during the period 2000 to 2003. Some timber enterprises which used only farm-grown timber reported that there had been an increase in timber availability. Procedures for obtaining permission to sell scattered trees and trees from plantations can be highly complex, involving the Communal People's Committee and the Forest Protection Unit, and sometimes the Provincial Forest Service and the Ministry of Agriculture and Rural Development.<sup>6</sup> There are overlaps between these administrative levels which lead to loose coordination and direction and complicated execution. Other difficulties reported by enterprises included capital shortage, old and technologically backward facilities, lack of land for plantations, high investment cost, difficulties in exporting products, complicated buying and selling procedures, low returns, poor living conditions, lack of economic development and competition from substitute products including plastic and artificial board furniture.

### **Future Prospects as Perceived by Owners of Timber Enterprises**

Table 11 reports opinions of respondents about the future of small-scale sawmilling and timber processing industry. In general, respondents did not hold an optimistic view of the future. The most pessimistic views were expressed in Son Duong district where over 75% of respondents anticipated a bad or very bad future. In contrast, in Dai Tu district, approximately 30% had pessimistic views on the future while 64% thought that the outlook of the industry would continue unchanged. About half of respondents in Tam Dao District and Phu Tho Province (44% and 55% respectively), held pessimistic or very pessimistic views, with some respondents saying that they intended to close down and change to other professions. Pessimistic views result from difficulties currently faced, which are not easy to solve and cannot be overcome in the short term. If effective actions are not taken to improve the sawmilling and timber processing industry, its future is not promising. Though some respondents in all study areas were found to believe in a bright or very bright future for the sawmilling and timber processing industry, the proportion overall was less than 20%.

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<sup>6</sup> Scattered trees are treated as agricultural products, and the tree owner has to inform the Communal People's Committee and the Forest Protection Unit in order to obtain a certificate showing that they have paid their agricultural tax. For trees in plantations of one ha or more, the selling application has to be submitted to the Provincial Forest Service, the Ministry of Agriculture and Rural Development and the communal FPU, and the tree owner has to pay 20% of the sale proceeds for administration fees to the Local Forestry Service.

**Table 11.** Opinions of interviewees about the future of the small-scale sawmilling and timber processing industry in Phu Tho Province and the TDNP buffer zone

| Prospect  | Phu Tho Province |    | TDNP Buffer Zone |    |                    |    |                 |    |
|-----------|------------------|----|------------------|----|--------------------|----|-----------------|----|
|           |                  |    | Tam Dao District |    | Son Duong District |    | Dai Tu District |    |
|           | No.              | %  | No.              | %  | No.                | %  | No.             | %  |
| Very good | 1                | 4  | 0                | 0  | 0                  | 0  | 0               | 0  |
| Good      | 4                | 16 | 2                | 11 | 0                  | 0  | 1               | 4  |
| Normal    | 9                | 36 | 6                | 33 | 5                  | 24 | 16              | 64 |
| Bad       | 7                | 28 | 6                | 33 | 13                 | 62 | 6               | 24 |
| Very bad  | 4                | 16 | 4                | 22 | 3                  | 14 | 2               | 8  |

## DISCUSSION

Small-scale sawmilling and timber processing activities fit well with the rural communities in northern Vietnam, creating permanent and seasonal employment as well as meeting the domestic demand of timber products. These enterprises include small sawmills and furniture manufacturing enterprises, and most are family-run and utilise farm-grown timber. A wide variety of farm-grown tree species, in particular indigenous species, are in high demand by timber enterprises, and a market exists for even very small logs. The market potential has not been fully exploited due to logging bans and complicated timber selling and buying procedures. Most survey respondents want to continue to work and would like to expand their operational scope outside the provincial and national boundaries if current difficulties experienced are removed. Rural economic development programs, product quality improvement and tree planting encouragement are potential solutions. In addition, the removal of financial and regulatory constraints such as complicated timber selling and buying procedures as well as availability of incentives for the expansion of the sawmilling and timber processing activities would result in a stronger sawmilling and timber processing industry.

Economic development activities will help to improve the living condition of local rural people, which in turn increases the purchase of timber products. Economic development activities are also necessary to provide incomes for farmers and to reduce the reliance, and hence pressure, of local people on the natural forests.

The industry can be expanded if the quality of timber products are improved. Timber products are designed for a relatively low quality and low price market, particularly in the TDNP buffer zone. The application of new science and technology, for example better milling and processing facilities, can help to make use of small logs and increase processing efficiency.

Reforestation is needed to overcome the timber shortage and to meet the demand for timber. Survey results indicate that the species farmers should be planting in home gardens or on farmland are fast-growing native and exotic species such as *Manglietia conifera*, *Melia azedarach*, *Acacia* spp. (particularly *A. auriculiformis* and hybrid acacias), *Artocarpus heterophyllus*, and high-value native tree species including *Chukrasia tabularis*, *Erythrophloeum fordii* and *Madhuca pasquieri*. The key issue is to devise means of making tree growing attractive to farmers and to

devise silvicultural methods allowing plantations of these species to be grown in appropriate sites. Financial and technical information on tree planting needs to be made available in an easily-understood form to farmers and other tree growers. Information can be made available through the form of video tapes and CD-ROM, posted on commune bulletin-boards or broadcast on mass communication means including television, radio and newspapers. If a network or organisation of farmers and tree growers is established, information can be disseminated more quickly and experiences among members can be shared. The farm-grown indigenous tree species plantations can, as a result, be further developed and expanded.

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